Agreement between California Energy Commission
and
Kennedy/Jenks Consultants, Inc.

Title: The Use of Novel Nanoscale Materials for Sludge Dewatering: A Field Demonstration
Amount: $299,956.00
Term: 31 months
PIER Contact: Anish Gautam
RD&D Committee: 12/3/2009

Funding

FY	Program	Area	Initiative	Budget	This Project	Remaining Balance	
09	Natural Gas	IAW	Natural Gas Efficiency RD&D for Industrial & Institutional Use	$1,400,000	$299,956	$400,000	28%

For the 2009 fiscal year, the total Natural Gas budget is $24 million. Within the Natural Gas program, the IAW program area budget is $1.8 million and, from this amount, $1.4 million was allocated to the Natural Gas Efficiency RD&D for Industrial & Institutional Use budget initiative. If approved, the remaining initiative balance will be $400,000.

Recommendation

Approve this agreement with Kennedy/Jenks Consultants, Inc. for $299,956.00, with $174,989 in match funding. Staff recommends placing this item on the discussion agenda of the Commission Business Meeting.

The Problem

Wastewater treatment consumes about 2000 million kilo-watt hours per year in California. Approximately 40% of this energy use is for sludge treatment and disposal. One of the reasons sludge treatment is energy intensive because of the large amount of energy required to remove water after aeration. Water removal is required to lower the volume to reduce hauling and disposal costs. Facilities ship the sludge hundreds of miles by truck for disposal, which significantly increases the carbon footprint of wastewater treatment in addition to the energy used to dewater the sludge.

Proposed Research

The proposed project will research the use of nanoscale materials to improve dewatering processes. The research will take the results of bench scale work that showed nanoscale materials enhanced the performance of polymer additives currently used in the dewatering process to develop a dewatering program. The goal will be to increase the volume of water removed while using less energy. Currently, dewatering processes increase the percent of solids in sludge from 3 to 4 % to approximately 25%. The proposed project will increase the percent of solids in dewatered sludge to approximately 30%. This increase in water removal would save approximately 30% of the energy in the dewatering process (approximately 240 million kWhr). It would also reduce the amount of natural gas needed to dry the sludge and reduce the amount of fuel and other shipping and disposal costs to remove the sludge.

Research Justification and Goals

This project "[will develop, and help bring to market] increased energy efficiency in buildings, appliances, lighting, and other applications beyond applicable standards, and that benefit electric utility customers" (Public Resources Code 25620.1.(b)(2)), (Chapter 512, Statues of 2006)) by:

- Improve the energy efficiency and lower the carbon footprint of sludge treatment at wastewater treatment facilities through the use of nanoscale chemical additives.

Background

The proposal was submitted through competitive solicitation, Emerging Technology Demonstrations Grants Program (ETDG) Opportunity Notice 08-006. This opportunity notice was structured to solicit proposals under four categories 1) Data Center, 2) Electricity Storage for Customer-side, 3)Industrial Energy Efficiency and 4) Water and Wastewater. This proposal was ranked 1 out of 12 proposals received through the solicitation under the Water and Wastewater category.

Dewatering of sewage sludge is done with a filter press after digestion and thickening. Following dewatering the sludge is gas dried and then shipped to be landfill. The dewatering process will increase the percent of solids in the sludge from 3 to 4 percent to approximately 25%. Filter presses will consume 2000 to 6000 kWhr/year per million gallons per day (MGD).

The proposed project is based on a bench scale study that used nanoscale additives to improve the performance of polymers used in dewatering processes. Polymers are added to sludge to improve a parameter called specific resistance to filtration (SRF). The SRF measures filtrate flow rate normalized to pressure applied through a filter press. A higher SRF will mean better performance of the filter press, resulting in a dryer sludge. The bench scale work showed that nanoscale additives added with the polymers increased the SRF by 30 to 50%.

The research will build upon previous bench scale work by testing different nanoscale additives with different sludge samples, determining optimum polymer concentration and reduction of polymer costs, and determining nanoscale additive concentrations, sequence of addition and mixing protocols. The researchers will also evaluate dewatering efficiency, supernatant quality and characteristics of treated sludge using standard methods. From these tests four nanoscale additive and polymer combinations will be field tested at the Los Angeles County Sanitation District Joint Water Pollution Control Plant in Carson, CA. The result will be an itemized estimate of energy savings and carbon foot print reduction along with increased sludge dewatering for different nanoscale treatment options.

If the volume of water removed can be increased during dewatering, energy savings will be achieved throughout the sludge treatment process. Increasing the solids content in the sludge will reduce solids in the centrate that is sent back to the front end of the treatment process, resulting in less aeration energy used for treating waste water. Less water in the dewatered sludge will reduce gas drying energy use. Increasing the percent of solids in dewatered sludge from 25 to 30% will lower the sludge volume by 20% and decrease the carbon footprint of the facility.